

Lower Middle Miocene Progradational Play

MM4 P1, #1961

Gyroidina "K" through Amphistegina "B"

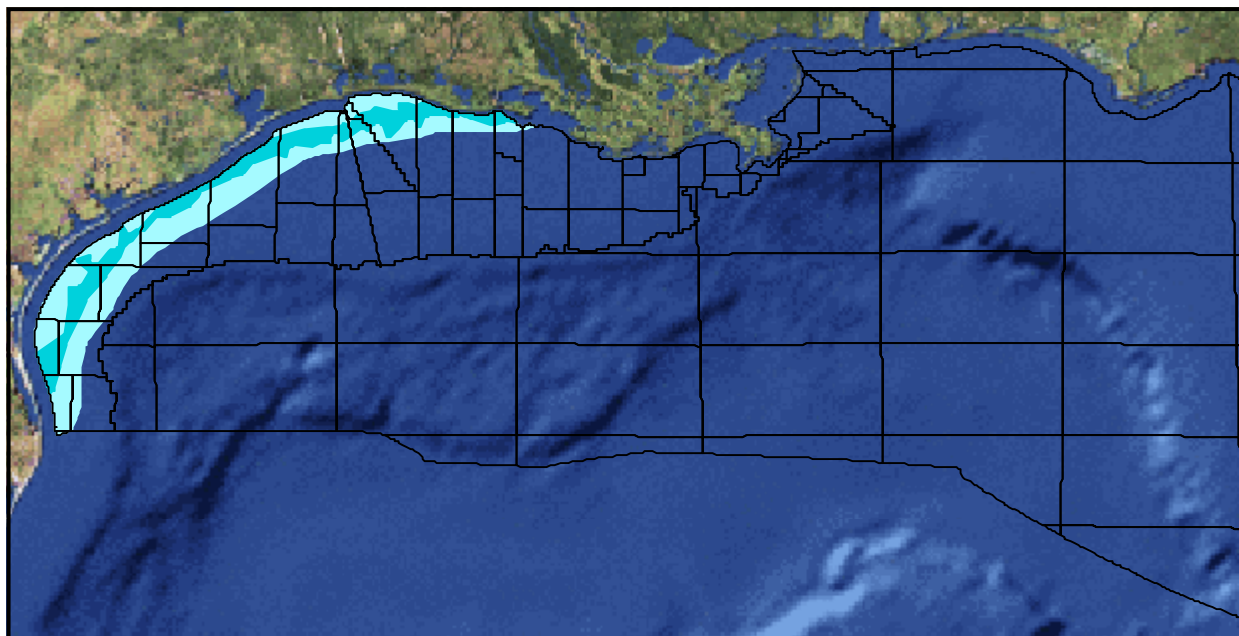


Figure 303. MM4 P1 map showing location of play. Play limit shown in light cyan; hydrocarbon limit shown in dark cyan.

Overview

The Lower Middle Miocene Progradational Play (MM4 P1) contains reserves of 7,535.950 Bcfg and 120.525 MMbo (1,461.442 MMBOE) in 474 sands in 85 fields. The play extends continuously across the modern GOM shelf from the South Padre Island to Eugene Island Area ([Figure 303](#)).

Description

MM4 P1 is defined by (1) a progradational depositional style representing major regressive episodes in which sediments outbuild onto the shelf and slope and (2) the MM-1, MM-2, MM-3, and MM-4 Chronozones, the tops of which are defined by the *Gyroidina* "K", *Cristellaria* 54/*Eponides* 14, *Robulus* 43, and *Amphistegina* "B" biozones, respectively ([Figure 8](#)).

MM4 P1 extends continuously across the modern GOM shelf from the South Padre Island Area offshore Texas to the Eugene Island Area offshore Louisiana ([Figure 303](#)). Hydrocarbons have been found in much of that area.

Depositional systems included the North Padre Delta System in the southern Texas area and the Calcasieu Delta System along the Texas-Louisiana border (Galloway et al., 1986). MM4 P1 extends laterally over a greater geographic area than does the progradational deposits of the Upper Lower Miocene (LM4) Chronozone. In addition, progradational sands of MM4 time occur farther basinward than those deposited in LM4 time.

Play Limits

Updip, the play extends onshore into Texas and Louisiana. The play continues to the southwest into onshore Texas and Mexican national waters. To the east, the play extends onshore into Louisiana. MM4 P1 deposits grade into the sediments of the Lower Middle Miocene Fan 1 Play (MM4 F1) in a downdip direction.

Depositional Style

Sediments deposited predominantly on the shelf characterize MM4 P1, with less common, generally

finer-grained sediments deposited on the upper slope also occurring. These sediments represent major episodes in which outbuilding of both the shelf and slope occurs.

The MM4 progradational interval varies greatly from approximately 50 to more than 8,600 ft in thickness, with net sand thicknesses as much as approximately 1,400 ft. MM4 P1 is punctuated by well-developed flooding surfaces, of which the *Cristel-laria 54/Eponides 14*, *Robulus 43*, and *Amphistegina "B"* are the most significant. A stacked series of progradational sequences that range from less than 100 to about 1,000 ft characterize the play. These sequences are best developed in the North Padre Island and Mustang Island Areas and the High Island to East Cameron Area. Progradational depositional facies, predominantly comprising shelf blanket sands, delta fringe sediments, distributary mouth bars, and channel/levee complexes, characterize MM4 P1. These facies exhibit upward-coarsening (distributary mouth bars and delta fringe) and blocky to upward-fining (channel/levee complexes) log signatures. The thickest sand-dominated intervals probably represent stacked facies of multiple episodes of delta-lobe switching and progradation. The play less commonly contains delta slump deposits that exhibit a serrated, blocky log signature and crevasse splay deposits that have an upward-fining log signature.

Structural Style

The majority of fields in MM4 P1 are structurally associated with normal faults and anticlines. Other common structures are associated with shale diapirs, with traps on the flanks of the diapir or in sediment drape over the diapir, and growth faults with rollover anticlines. The least common structures include accumulations trapped along unconformities.

Quantitative Attributes

On the basis of reserves calculations, MM4 P1 contains 92% gas and 8% oil. The 474 sands in the play comprise 810 reservoirs, of which 770 are non-associated gas, 28 are undersaturated oil, and 12 are saturated oil. Proved reserves are estimated at 7,529.734 Bcfg and 120.489 MMbo (1,460.299 MMBOE) in 473 sands in 84 fields (Table 145). Unproved reserves are estimated at 6.216 Bcfg and 0.036 MMbo (1.142 MMBOE) in 1 sand. These

	No. of Sands	Oil (MMbbl)	Gas (Bcf)	BOE (MMbbl)
Proved	473	120.489	7,529.734	1,460.299
Cum. production	427	100.888	6,344.207	1,229.750
Remaining proved	286	19.601	1,185.527	230.549
Unproved	1	0.036	6.216	1.142

Table 145. MM4 P1 reserves and cumulative production.

proved plus unproved reserves account for 72% of the reserves for the MM4 Chronozone.

Cumulative production from MM4 P1 totals 6,344.207 Bcfg and 100.888 MMbo (1,229.750 MMBOE) from 427 sands in 82 fields. This production accounts for 72% of the MM4 Chronozone's total production. Remaining proved reserves in the play are 1,185.527 Bcfg and 19.601 MMbo (230.549 MMBOE) in 286 sands in 68 fields.

Table 146 summarizes that water depths of the fields in MM4 P1 range from 11-212 ft, and play interval discovery depths vary from 5,160-17,500 ft, subsea. Additionally, porosity and water saturation range from 15-35% and 16-63%, respectively.

474 Sands	Min	Mean	Max
Water depth (ft)	11	79	212
Subsea depth (ft)	5,160	8,623	17,500
Reservoirs per sand	1	2	17
Porosity	15%	27%	35%
Water saturation	16%	33%	63%

Table 146. MM4 P1 sand attributes. Values are volume-weighted averages of individual reservoir attributes.

Exploration History

MM4 P1 has a 44-year history of discoveries (Figure 304). The first sands in the play were discovered in 1955 in the Galveston 189 and West Cameron 71 Fields. The maximum number of sands discovered in any year occurred in 1988 with 42 sands from 15 fields. However, the maximum yearly reserves of 163.324 MMBOE were added in 1958 with the discovery of just 3 sands in 2 fields. This includes the largest sand in the play in the Tiger Shoal Field. This sand contains an estimated 132.055 MMBOE (Figure 305). Only two other sands containing more than 50 MMBOE have been found in the play. The mean sand size for the play is 3.083 MMBOE. Discoveries peaked from 1979 to 1990 when 273 sands were added to the play. Since the first Atlas database cutoff of January 1, 1995, 26 sands have been discovered, the largest of which is estimated to contain 8.020 MMBOE.

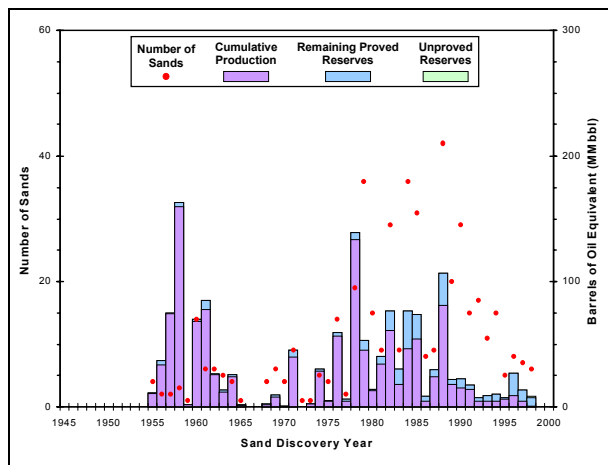


Figure 304. MM4 P1 exploration history graph showing reserves and number of sands discovered by year.

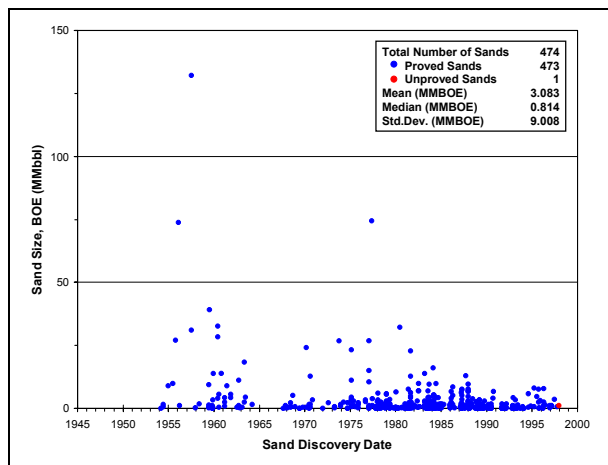


Figure 305. MM4 P1 sand discovery graph showing the size of sands discovered by year.

Production History

MM4 P1 has a 42-year history of production (Figure 306). Production from the play began in 1955, but ceased during 1958 and 1959, as the only producing field at the time, Galveston 189, had depleted two of its MM4 P1 sands and stopped producing from the other for a number of years. Production began again in 1960 and rose steadily until the early 1980's, before declining in the mid-1980's. Gas production again increased and peaked in 1993, and since then has declined to about 70% of its peak level. In comparison, oil production also increased, but reached and all-time high in 1998.

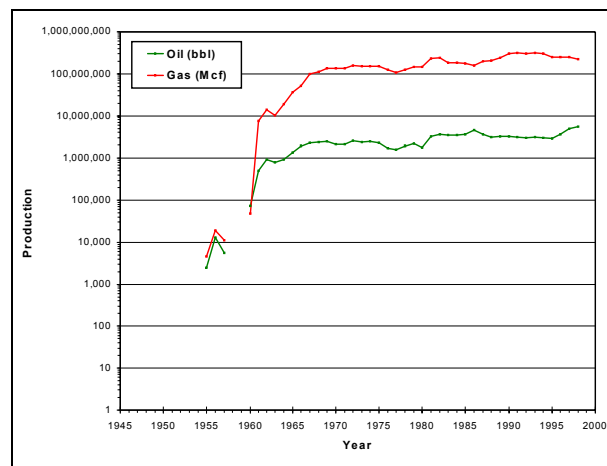


Figure 306. MM4 P1 production graph showing oil and gas production by year.